20 V steps for a total of 40 shocks. Energy and impedance were recorded from a waveform analyzer. The energy of all shocks for each volume state were then averaged to provide an estimate of ED50.

Conclusions: Reducing ventricular volume significantly lowers ED50 defibrillation energy. This may be caused directly by the decrease in blood volume as evidenced by the increased impedance and/or may be due to changes in heart geometry and stretch.

4:30

811-3 Defibrillation Threshold in the Isolated Rabbit Heart: Effect of Ventricular Dilatation

Peter Ott, Michael J. Reiter. *University of Colorado, Denver, CO*

We studied the effects of acute ventricular dilatation (VD) on defibrillation thresholds (DFT) in 19 isolated, Tyrode perfused, rabbit hearts. *Methods:* A latex balloon in the left ventricle was filled with 1.0 ml of normal saline [n = 10], or 5% dextrose [n = 9] to achieve VD. Ventricular fibrillation was induced by rapid ventricular stimulation, and, after 10 seconds, a monophasic shock wave (12 ms pulse width) was delivered. A circular, mesh-wire patch electrode (1.76 cm^2), placed over the posterior left ventricle, served as cathode and the metallic aortic cannula served as anode. A modified down/up protocol, with voltage steps of 10 Volts, was used to determine the DFT. *Results:* Data is shown in mean ± Standard Error for zero volume ([0]) and dilated volume ([d]).

	DFT (volts)	ERP (ms)	EDP (mmHg)
[0], n = 19	96 ± 4	117 ± 3	0 ± 1
[d], n = 19	125 ± 7*	99 ± 3*	35 ± 3*

*p < 0.001; paired two-sided t-test, [0] versus [d] volume. EDP = end-diastolic pressure, ERP = effective refractory period

VD decreased ERP (15%) and increased DFT (30%). The increase in DFT was unaffected by the balloon solution. *Conclusion:* (1) Acute VD, in this model, significantly increases DFT. (2) The precise mechanism remains unknown.

4:45

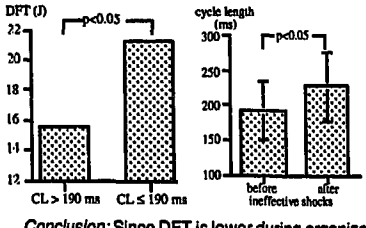
811-4 Do Unsuccessful Subthreshold Defibrillation Shocks Enable Subsequent Successful Defibrillation With Lower Energy?

Sybille Heinz, Eckhard Alt, Claus Schmitt, Albert Schömig. *I. Med. Klinik, Klinikum rechts der Isar, Technical University München, Germany*

Background: The morphology of ventricular fibrillation is mainly characterized by frequency content, amplitude, and cycle length (CL). The aim of this study was to determine if subthreshold defibrillation attempts affect ventricular fibrillation morphology (VFM) and influence the defibrillation threshold (DFT) of subsequent successful defibrillation shocks.

Methods: DFT was determined in 16 pts during implantation of a subpectoral defibrillator (Medtronic PCD 7219 C/D) connected to a transvenous electrode (Medtronic 6936/6934) placed in the right ventricular apex. Intracardiac and surface (lead II) ECGs were recorded. A total of 24 episodes with ineffective defibrillation shocks were analyzed.

Results: There was a significant difference in CL during fibrillation between organized fibrillation complexes (type 1) and unorganized complexes (type 4). CL was noticably increased for a few seconds following the application of an unsuccessful shock. DFT was significantly lower with long CL than with short CL.



Conclusion: Since DFT is lower during organized fibrillation and subthreshold shocks create a short period of more organized fibrillation, it makes sense that a preconditioning shock shortly ahead of a principal defibrillation shock would require less energy to be successful. Using this principle in implantable defibrillators might increase the safety margin or enable the use of smaller capacitors, thus reducing implant size.

812 Stress Echo as a Prognostic Tool

Wednesday, March 27, 1996, 4:00 p.m.–5:00 p.m.
Orange County Convention Center, Room 230C

4:00

812-1 Exercise Echo Predicts Cardiac Events Independent of Exercise Findings at Small Incremental Cost — 4 Year Follow-up in 500 Patients

Thomas H. Marwick, Rajendra Mehta, Kris Arheart, Kamthorn S. Lee, Fredric Pashkow. *Cleveland Clinic Foundation, Cleveland, OH*

Ischemia (ISC) at exercise echo (ExE) predicts subsequent cardiac events. This study examined the incremental benefit and cost of ExE according to the results of exercise testing (ExT) in 500 consecutive pts undergoing treadmill ExE. ISC was identified by development of a new or worse wall motion abnormality. Primary revascularization (RVS) was undertaken within 3 months in 16 pts, and 21 (4%) were lost to follow up. The remaining 463 pts (57 ± 12 y, 302 men) were followed over 44 ± 11 m, during which 81 pts (17%) suffered events including 33 (7%) with hard events (HrE; 19 unstable angina or infarction, 14 cardiac death) and 48 required late RVS due to progressive symptoms. *Results.* Univariate predictors of HrE were; ISC (RR 10, p < 0.0001), METS (RR 5.9, p = 0.01), infarction (RR 3.3, p < 0.001) and ST depression > 0.1 mV (RR 1.8, 0.01). In a Cox model, only ISC (p = 0.0001) and ex capacity (p = 0.003) predicted HrE. Classically, METS < 6 best define risk of HrE by ExT. When ISC and METS were combined, HrE occurred in more pts with ISC whether METS were < 6 or ≥ 6 (28% vs 15%, p = NS), and few pts without ISC at METS < 6 and ≥ 6 (4% vs 1%, p = NS). Cost and benefit of ExT and ExE were assessed by assuming that all high-risk pts by ExT (METS < 6, n = 112) and ExE (ISC, n = 132) underwent angiography and that subsequent intervention prevented hard events. HrE were assumed to occur only in pts identified as low risk. The cost of risk assessment (cost of ExT or ExE + angios in positive tests) was derived from Medicare reimbursement in NE Ohio;

	HrE in low-risk pts by ExT or ExE	Angios	Cost/pt	Cost/HrE saved
ExT	18 (4%)	112	$407	$12,577
ExE	7 (1.5%)	134	$658	$11,720

Conclusions. ISC by ExE predicts pts liable to suffer events, independent of ExT. Use of ExE to identify high risk is associated with fewer events in low risk pts and though cost/pt is greater than with ExT, cost/HrE saved is less.

4:15

812-2 Ischemia, Rather Than Scar, by Dobutamine Stress Echocardiography Predicts Adverse Outcome in Patients With Chronic Left Ventricular Dysfunction

Steven C. Smart, Thomas Knickelbine, John Wynsen, Kiran B. Sagar. *Medical College of Wisconsin, Milwaukee, WI*

Dobutamine stress echocardiography (DSE) detects coronary artery disease in patients with resting dysfunction by three responses: scar (fixed severe dysfunction with wall thinning), biphasic (resting dysfunction, improvement low dose, worsening at peak dose), or scar with ischemia (resting dysfunction with thinning, no change at low dose, new abnormality at peak dose). To investigate if scar or ischemic responses (biphasic or scar with ischemia) are predictive of adverse outcome and if outcome is altered by revascularization in high risk patients, 63 patients with moderate to severe chronic left ventricular dysfunction (age 62 ± 13 yrs, 32 women/31 men, ejection fraction 30 ± 7%, Q-waves in 11) underwent multistage DSE (rest, low dose-5 & 10 mg/kg/min, and peak dose) and were followed for 1 year. Peak dose and heart rate were 24 ± 10 mg/kg/min and 124 ± 19 bpm, respectively. Atropine was used in 22 patients. Ten patients were revascularized (7 bypass surgery, 3 angioplasty). There were 16 cardiac events (12 cardiac deaths, 4 nonfatal myocardial infarctions). Twenty patients were classified as scar, 32 as ischemic (20 biphasic, 12 scar with ischemia), and 11 as nonischemic (sustained improvement at low and peak dose). Event rates were as follows:

DSE Result	Medical Therapy	Revascularization
Scar	15% (3/20)*	
Ischemia	59% (13/22)	0% (0/10)+
Biphasic	55% (6/11)	0% (0/9)+
Scar w/ischemia	64% (7/11)	0% (0/1)
Nonischemia	0% (0/11)*	

*p < 0.05 vs ischemic, biphasic, scar w/ischemia, +p < 0.05 vs medical

Scar was not predictive of adverse outcome. Both types of ischemic re-

WEDNESDAY ORAL